Elliott Python Project

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1 Tasks

1.1 Catalog Object

Create an object called Catalog that can hold all information for a given catalog of sources. Catalog should have the following capabilities:

1. Use votable to read a sky catalog into the object.

2. Relatively quickly search for sources with certain attributes (i.e. on certain parts of the sky, with certain brightnesses, etc).

3. Read additional catalog items into an existing object, allowing them to be at different frequencies than existing sources.

4. Handle unit conversions by user.

1.2 Spectral Interpolation

Write an algorithm to interpolate between fluxes at known frequencies to estimate source fluxes smoothly across frequency axis. The algorithm should be able to handle nonlinear flux slopes, and should be able to extend beyond the last frequency provided by the catalog. This algorithm should be a method on your Catalog object.

1.3 Visualization

All of your visualizations should be a method on your Catalog object.

1. Visualize frequency interpolation for individual sources, showing known frequencies as well as the calculated frequencies

2. Make source map on the sky at a given frequency, showing source locations and brightneses

3. Create a movie of the sky map as you move along the frequency axis

2 Helpful Info

2.1 The catalog

The catalog you'll use is called GLEAM - it's a catalog of radio frequency sources in the southern sky. You can read more about it here: `https://www.mwatelescope.org/science/galactic-science/gleam/`

The easiest way to do this is using a packaged called pyradiosky. You'll need to install pyradiosky using conda, then use the associated utility function utils.download_gleam function to download the GLEAM catalog. Documentation for pyradiosky is available here: `https://pyradiosky.readthedocs.io/en/latest/index.html`

2.2 Reading the catalog

You'll start by using the votable package, but will want to move the table into astropy quickly, since that's much more usable. You will also likely want to use astropy for any unit conversions and other features, so I recommend reading a little about it. Here's some sample code to get you started reading the table:

```
from astropy.io.votable import parse
votable = parse("path-to-gleam.vot")
table = list(votable.iter_tables())[0]
astr_table = table.to_table()
print(astr_table.colnames)
```

From here you should be able to use astropy documentation to access necessary elements of the table.